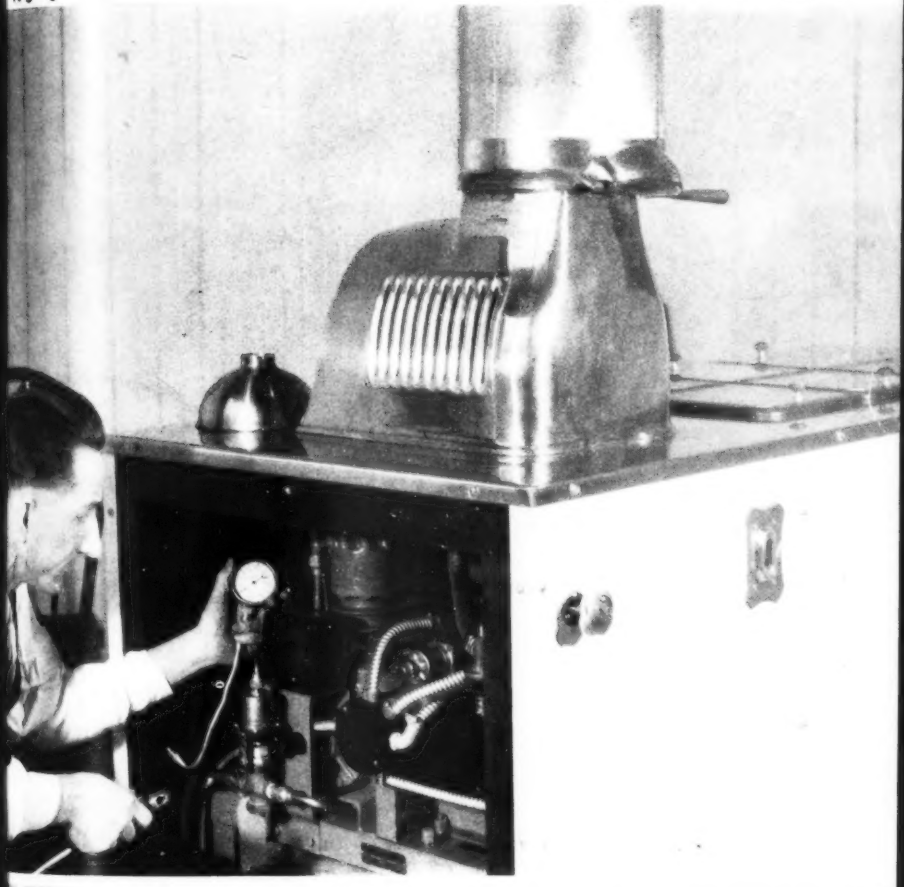
The Refrigeration Service Engineer

MAR 6 - 1934
LIBRARY

Vol. 2
No 3

MARCH · 1934



Heating and Cooling System—Service of Servel Mechanisms—The Control of Refrigerants—Service Pointers

MELCO
REG. U.S. PAT. OFF.

For Service

NOW IS THE TIME to plan for the coming refrigeration season. Check your requirements—valves, copper tubing, belts, controls, refrigerants, coils. Do not overlook—

FEDDERS CONTINUOUS TUBE

FORCEDRAFT

UNIT COOLERS

There is business to be had in replacing old installations with these Forcedraft Coolers. They fit easily in new or old boxes. Their operating cost is low. They are made for all refrigerants except ammonia. Automatic temperature control is provided by Fedders Thermostatic Expansion Valve.

Catalog, prices and specifications will be furnished on request

MELCHIOR, ARMSTRONG, DESSAU CO.
of Delaware, Inc.
300 Fourth Avenue
NEW YORK, N. Y.

1516 Callowhill Street
PHILADELPHIA, PA.

614 Memorial Drive
CAMBRIDGE, MASS.

Now Ready

A Great Book

Now Even GREATER

FOURTH EDITION *by* H. B. HULL

HOUSEHOLD REFRIGERATION

The Only Book of Its Kind Published

ENTIRELY REVISED—200 PAGES ADDED

MORE VALUABLE THAN EVER

THE Fourth Edition of HOUSEHOLD REFRIGERATION will be ready for distribution shortly. It contains up-to-the-minute information on new developments in household refrigeration, current up to the time of going to press. It is a book of 700 pages—200 additional pages over the previous edition.

It is the only book published on this important subject today, covering in detail the principles, types, construction and operation of both ice and mechanically cooled domestic refrigerators. During the past six years, changes of tremendous importance have occurred in the design, construction and operation of household refrigerating units. New designs, new refrigerants, new principles have been adopted. All are contained in this new Fourth Edition. It is an invaluable book for designers, manufacturers, dealers and distributors of mechanically cooled refrigerators.

700 PAGES

270 ILLUSTRATIONS

CLOTH BINDING

—

MOROCCO $5.00

$4.00 Post Paid

Published by

NICKERSON & COLLINS COMPANY

435 N. Waller Ave.

CHICAGO, ILL.

FOR YOUR CONVENIENCE USE THIS ORDER

NICKERSON & COLLINS COMPANY, PUBLISHERS, 435 N. Waller Avenue, Chicago, Ill.

Please send to the address below, a copy of the Fourth Edition of HOUSEHOLD REFRIGERATION, bound in.....
(Indicate Cloth or Morocco).

☐ Enclosed is remittance. ☐ Send Bill.

Name .....

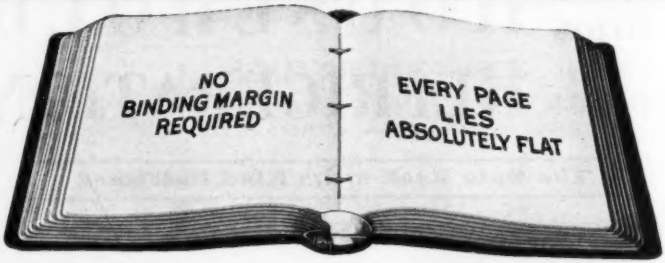
Address .....

City..... State.....

CLOTH BINDING $4.00 MOROCCO $5.00

BIND—your copies of
THE REFRIGERATION SERVICE ENGINEER
for Future Reference

ALL COPIES ARE PUNCHED TO FIT THIS BINDER



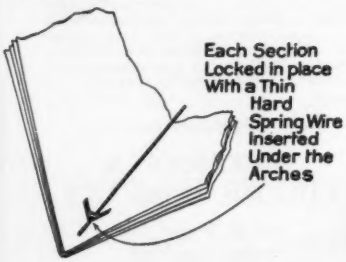
Every issue of this magazine will have valuable information which you will want to retain for future reference.

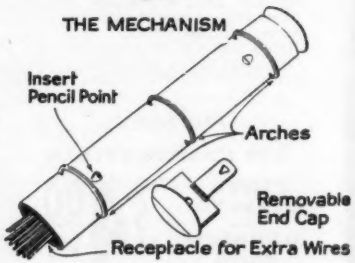
Here is a handy, substantial binder that permits you to add each copy readily as it is received. The binder is so constructed that regardless of the number of issues, every page lies flat and is easily read.

Holds twelve issues—an entire year's supply. No hunting around for lost or missing issues. The entire year's edition is always handy.

The name of the magazine is attractively stamped on the front cover in gold.

Only $1.00 postpaid





It's simple — here is how it works

Each issue is locked in place with spring wire. It takes only an instant to add an issue. Reserve supply of extra wires for future issues is kept in the back-bone of the binder. File your copies promptly as received.

Send Your Remittance of $1.00 to

THE REFRIGERATION SERVICE ENGINEER
433 NORTH WALLER AVE. CHICAGO, ILL.

The REFRIGERATION SERVICE ENGINEER

Devoted to the Servicing of
REFRIGERATION UNITS *and* OIL BURNERS

VOL. 2 MARCH, 1934 NO. 3

Table of Contents

PUBLISHED MONTHLY BY
NICKERSON & COLLINS COMPANY
433-435 NORTH WALLER AVE., CHICAGO, ILL.
EASTERN OFFICE: 149 BROADWAY, NEW YORK CITY

Publishers for 42 years of Technical Books and Trade Journals Serving the Refrigeration Industries.
Subscription: United States $2.00 per year. Single copies 25c. All other countries $3.00 per year.

Copyright, 1934, by Nickerson & Collins Co., Chicago

ANSUL

SULPHUR DIOXIDE

The choice of many service organizations. Pure, bone dry, laboratory tested. Available from 40 warehouses.

METHYL CHLORIDE

Fast freezing, stable, non-corrosive. Laboratory tested to assure low moisture and acid content.

ANSUL CHEMICAL CO.
MARINETTE - WISCONSIN

TRUE COMMUTATORS-
THE RECOMMENDED WAY!

Leading refrigerator manufacturers recommend the IDEAL way of truing Commutators. No dismantling of motors, no shutting down of refrigerator service and no muss. This type of maintenance service is what every housewife appreciates.

The "IDEAL RESURFACER" is far past the experimental stage. Used as the standard commutator truing device in the industrial field for 18 years—17,000 customers.

Easy to use. Just apply on commutator while in service. Trues commutator and cuts down high mica. Perfect commutation is assured.

ONLY 75c ea.

Order One for Trial Today!

IDEAL COMMUTATOR DRESSER CO.
1093 Park Ave., Sycamore, Ill.

DU PONT

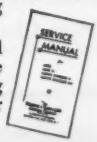
Artic

REG. U. S. PAT. OFF.

(DU PONT METHYL CHLORIDE)

Strict production control and analytical tests on ARTIC before shipping assure you of receiving a product *always* low in moisture and acidity, high in purity.

Adequate stocks of ARTIC are carried by distributors strategically located throughout the country, assuring prompt filling of orders. An ARTIC distributor is located near you.



Our experience of many years in manufacturing and handling ARTIC is summarized in a booklet for service men containing information on handling, servicing, testing for leaks, and other items of interest. Send for your free copy.

R&H Chemicals

THE R. & H. CHEMICALS DEPT.
E. I. DU PONT DE NEMOURS & COMPANY, INC.
Wilmington, Delaware

District Sales Offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Kansas City, Newark, New York, Philadelphia, Pittsburgh, San Francisco

The Refrigeration Service Engineer

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

OFFICIAL ORGAN REFRIGERATION SERVICE ENGINEERS' SOCIETY

VOL. 2, NO. 3 CHICAGO, MARCH, 1934 $2.00 per Annum

Service of Servel Mechanisms

Practical Tips on Operation of Servel High-Side Float. The Performance of the Throttle Control in the Suction Line. Balancing the Throttle Against the Action of the Gas Pressure.

By R. L. HENDRICKSON, R. E.*

IN all probability, the most difficult electric refrigerator to service is the old model Servel. Doubtless, this is due to the serviceman's unfamiliarity with the component parts of the machine. The operation of the float and the pressure control-switch assembly should be understood before an attempt is made to service the machine.

The oldest type of hi-side float used on the Servel by the Electric Products Corp., was of the intermittent flow type; that is, the liquid level in the float chamber was constantly changing during operation, thus when the liquid reached a predetermined level the needle was pulled from its seat and liquid flowed into the evaporator until the float chamber was almost empty. However, this float has almost disappeared from service therefore discussion can be confined to the later type.

The more recent Servel hi-side float is a constant-flow type. The needle is attached to the float arm so that any movement of the float ball will be transmitted directly to the vertical motion of the needle. The needle is positively seated in a bronze seat which is surrounded by a screen to prevent any foreign substance from circulating through the system.

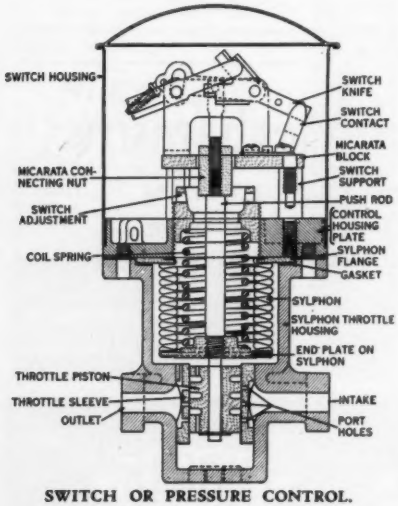
The float ball can be calibrated by removing the cover and bending the arm so that, when the needle is seated, the ball will extend one quarter inch above the chamber. When properly calibrated, it should require three quarters of a pound of CH_3CL to open the needle valve.

The entire charge of a Servel is two and one quarter pounds. From this, it will be seen that 1¾ pounds will always be in the low side. No excess refrigerant can be stored in the system as with the low-side float or expansion valve, therefore, the service man should take particular care in balancing the charge in order to get the maximum efficiency from the machine. Hi-side systems are all known as, "balanced charge systems." A hi-side float has a tendency to "gas bind" if the system is contaminated with air. The same symptoms are evident when the float is located in a warmer place than the condenser coils, or above the condenser where it has a chance to become warmer during

* Engineer of the Utilities Engineering Institute, Chicago, Ill.

the off cycle. This is due to evaporation taking place in the float chamber which causes the machine to make several short cycles before a pressure differential has been established between the float and condenser.

In view of the fact that the machine contains the greater portion of the refrigerant in the low side, it is necessary to control or throttle the flow of refrigerant vapor to the compressor when a warm box is started up.



SWITCH OR PRESSURE CONTROL.

This is accomplished by placing a throttle control in the suction line. The throttle is designed so that it can be utilized to govern the operation of the machine by a snap action switch mounted at the top of the push rod, which is attached to the end plate of the sylphon bellows.

The difficulty in servicing this assembly arises in balancing the throttle against the action of the gas pressure along with the proper travel of the switch mechanism. When the switch head is to be removed it is necessary to pump down the low side to about 2 or 3 lbs. pressure. This will prevent the breaking of the micarta block when the screws holding the block are removed. It also pulls the throttle down to the bottom of the throttle sleeve, which holds it in the proper place when the switch head is replaced. When the switch head is ready to be replaced, snap the contacts open, then screw it on to the micarta sleeve until the switch block just touches the three studs. Now give the switch two thirds of a turn more to prevent the end plate of the sylphon from touching the bottom of the sylphon housing. If this is not done the switch will not turn off at any pressure.

The round brass adjustment nut controls the cut-off pressure. By screwing the nut down the cut-off pressure is raised. This operation can be performed with a small center punch inserted in the holes of the nut. Ordinarily the pressure setting is found to be satisfactory if the machine is cut off at about 10 lbs. pressure. This control, as described, cannot be adjusted for pressure differential but the differential can be changed by replacing the coil spring under the adjusting nut. A lighter spring decreases the differential and a heavier spring increases the differential.

When the throttle is properly adjusted it will throttle the suction pressure from 20 lbs. (cut in pressure) to about 15 lbs. in a period of one to two minutes, then the pressure will gradually fall until the cut-out pressure is reached.

Occasionally the small spring in the switch head will break. This can be replaced by springing the flippers apart far enough to allow the "U" shaped bar to drop down thus releasing the guide bar and allowing the spring to drop out. In this operation, there must be pressure on the switch head when the spring is removed.

S S S

George Menge,
Pennsylvania.

"Will take this opportunity of telling you that I like THE REFRIGERATION SERVICE ENGINEER very much and I think a lot of knowledge is to be derived from reading same."

K. R. Smith,
Massachusetts.

"I wish you continued success in the publication of your most valuable magazine."

Determining Capacities of Thermostatic Expansion Valves

Accurate Tests Determine Capacities of Thermostatic Expansion Valves Using Various Refrigerants. Illustrating Method and Apparatus Used for Tests.

By J. ASKIN*

THE tremendously increasing use of electric refrigeration in commercial installations, as well as air conditioning, has brought about an increased demand for accurate information regarding capacities of thermostatic expansion valves. The following report gives the results of a series of engineering tests made in the laboratory of the Fedders Manufacturing Company at Buffalo, N. Y.

Figure 1 shows the arrangement of the apparatus. From left to right can be seen the drum of refrigerant, the balance scale

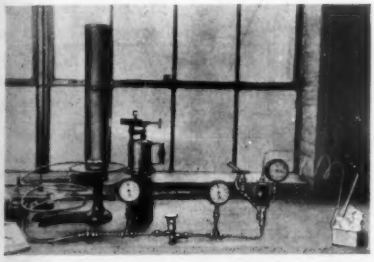


FIG. 1. TEST SET-UP FOR EXPANSION VALVE CAPACITY TEST

on which the drum of refrigerant set; a torch for maintaining a constant pressure within the drum; a flexible liquid line, which did not interfere with the accurate measurement of the weight of refrigerant made on the scale; a liquid filter; a gauge; a shut-off valve; another gauge; a thermostatic expansion valve with the bulb immersed in an ice water solution, maintaining a superheat temperature of 32° F. at the bulb; a gauge to indicate the back pressure of the valve; a back pressure gate valve, which regulated the pressure at the outlet of the valve; and a line leading outdoors, where the refrigerant was discharged.

FIG. 2. COMPUTING TEST

Fig. 2 shows the method of conducting these tests. The liquid valve was opened up wide; the torch was applied to maintain a constant pressure on the tank; the balance was set for a predetermined weight loss in the tank, say one pound, and when the pound of refrigerant went through the valve, the time was recorded with a stop watch. The back pressure was maintained by manipulating the gate valve at the right. Thus a constant inlet pressure to the valve, a constant back pressure of the valve, and a constant superheat temperature at the bulb could be maintained by stirring the ice water in which the bulb was immersed.

The readings were taken with the valve wide open, that is, with the adjusting thumb nut at the top of the power element completely opened up by turning it in a clockwise direction. To be absolutely sure that the valve was wide open when this method of adjustment was made, this was subsequently checked by removing the power

* Chief Engineer, Refrigeration Div., Fedders Mfg. Co.

element of the thermostatic expansion valve, placing a cap on the valve and inserting a positive acting screw, which opened up the valve wide. These readings of flow checked with the readings taken when the power element was connected to the valve and the bulb immersed in 32° F. ice water, and the adjusting thumb nut turned clockwise as far as it would go.

Valves having the following orifices were tested: .093" diameter and .156" diameter.

The following refrigerants were used: Sulphur dioxide, Freon (F-12), and methyl chloride.

With sulphur dioxide refrigerant, the inlet pressures to the valve were kept at 42 lbs. and 75 lbs. With F-12 refrigerant, the inlet pressures were 80 lbs. and 120 lbs. With methyl chloride refrigerant, the inlet pressures were 68 lbs. and 110 lbs. The back pressures at each inlet pressure were varied accordingly and the flow of refrigerant recorded. From the flow of refrigerant inlet pressure and outlet pressure, the tons of refrigeration (per 24 hours) was computed.

Making further computations, it was observed that apparently the flow of liquid refrigerant through a valve depended upon the pressure differential between both sides of the valve.

A very convenient curve, showing the complete summary of the tests above, is shown in Figure 3, which enables one to obtain the capacity of either of the valves with any refrigerant and with any pressure differential. For example, suppose methyl chloride is the refrigerant: Assume a discharge pressure of 100 lbs. and a suction pressure of 10 lbs., giving a pressure differential of 90 lbs. Assume the orifice is .093". The pressure differential becomes 90 lbs., and the capacity of the valve is 6.85 tons per 24 hours. It is necessary to bear in mind that this capacity represents the capacity through a valve without any friction loss in the evaporator coils. Allowance should be made for this friction loss. Also, the capacity represents the full wide open capacity of the valve with a super-

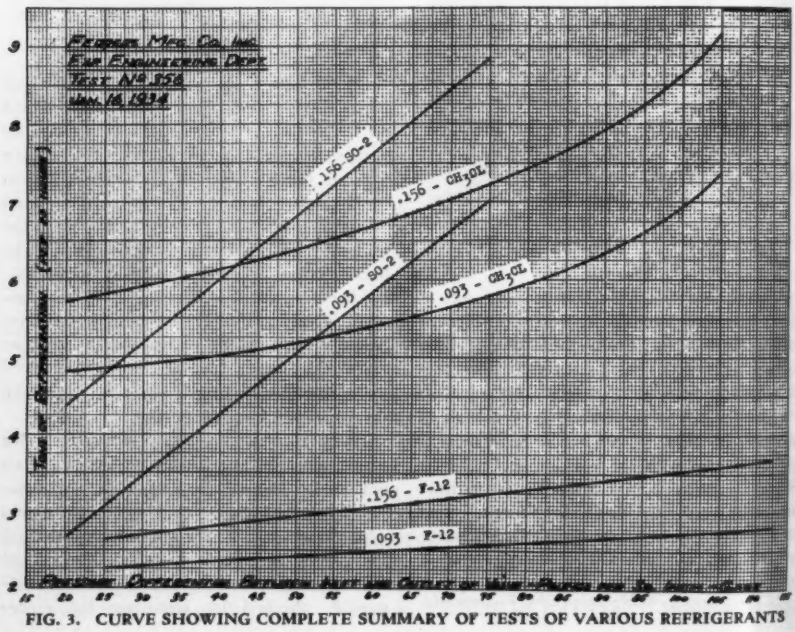


FIG. 3. CURVE SHOWING COMPLETE SUMMARY OF TESTS OF VARIOUS REFRIGERANTS

heat temperature at the bulb of the thermostatic power element of 32° F. It is seldom that a valve is used in its wide open position, and therefore allowance should be made for this also. Oil, when mixed with the refrigerant, acts as an inert fluid, so far as obtaining refrigeration is concerned, and allowance should be made, depending upon the amount of oil circulated.

It is the writer's opinion that 50% of the capacities given in Figure 3 will take care of all of the above factors.

The Control of Refrigerants . . .

ARTICLE NO. 8 THE THERMOSTATIC EXPANSION VALVE

Controlling the Evaporator by the Thermostatic Expansion Valve. The Effect of Superheat on the Valve Action. Controlling Various Units by the Thermostatic Valve.

By J. L. SHRODE*

THE graph in Figure 1 shows the inlet and outlet temperatures of an evaporator controlled by a thermostatic expansion valve. The superheat of this system is also plotted and it is readily seen that the superheat remains fairly constant. On this system when the load was increased the outlet temperature increased for the same reasons as outlined above. This increased bulb temperature opened the expansion valve causing the suction pressure and the evaporator inlet temperature to rise. With the expansion valve feeding more ammonia, more of the evaporator was frosted and the superheat decreased. The evaporator outlet temperature then became lower and the valve closed slightly, lowering the inlet temperature. Every increase in the evaporator outlet temperature was followed by a corresponding increase in the inlet temperature since the valve opened every time the bulb temperature increased. Conversely, whenever the evaporator outlet temperature decreased, the inlet temperature also decreased.

When the load decreased the evaporator outlet temperature was lowered and, therefore, the inlet temperature dropped. The temperature difference between them, that is the superheat, remained practically constant during all of the load changes. The amount of superheat was fixed by the valve adjustment. The thermostatic expansion valve tends to maintain a constant superheat at the evaporator outlet regardless of load changes. This is clearly shown in the graph.

Any variation in the amount of superheat causes the thermostatic valve to regulate the flow of the refrigerant in such a way as to correct the existing condition. If, for example, the suction gas is very wet and moist vapor is going back to the compressor, the superheat at the thermostat bulb is materially lower than the setting of the valve. The bulb is cooled, the pressure in the bulb and above the diaphragm is correspondingly reduced, and the valve closes off some. Since less refrigerant is then admitted to the evaporator, the suction gas becomes drier, and the compressor no longer needlessly pumps liquid. When the suction gas is too highly superheated the reverse, of course, is true; the higher bulb temperature causes a higher pressure above the diaphragm and the valve opens admitting more refrigerant. In either case the valve quickly restores the amount of superheat to the predetermined setting. It can be readily seen that the thermostatic valve will always feed the amount of refrigerant required for the load carried.

Consider the installation shown in Figure 2. The system shown consists of a meat cooler and a display counter fed in parallel by one compressor. Thermostatic valves are installed in each unit (note that the remote

* President, Alco Valve Co., St. Louis, Mo.

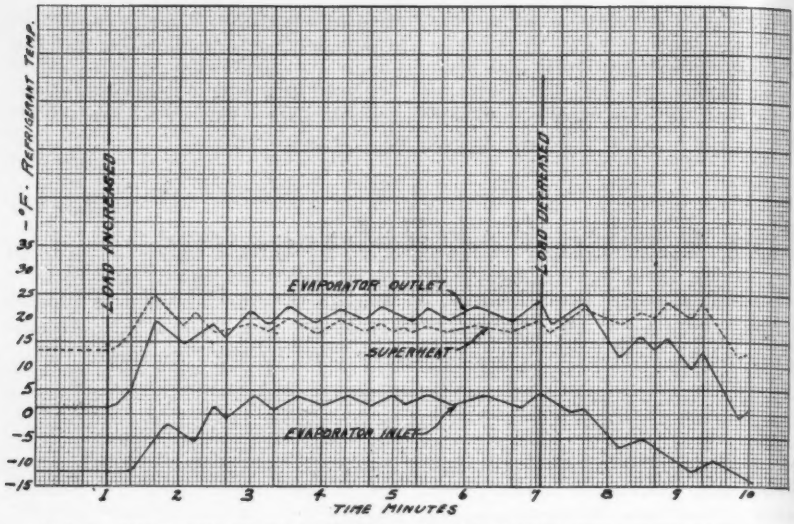


FIG. 1. INLET AND OUTLET TEMPERATURES OF EVAPORATOR CONTROLLED BY THERMOSTATIC EXPANSION VALVE.

bulbs are located inside of the units) and a thermostat installed in the meat cooler operates the compressor. At the start the thermostat bulbs are warm and the valves are, therefore, wide open, permitting a maximum flow of refrigerant. As the units are cooled,

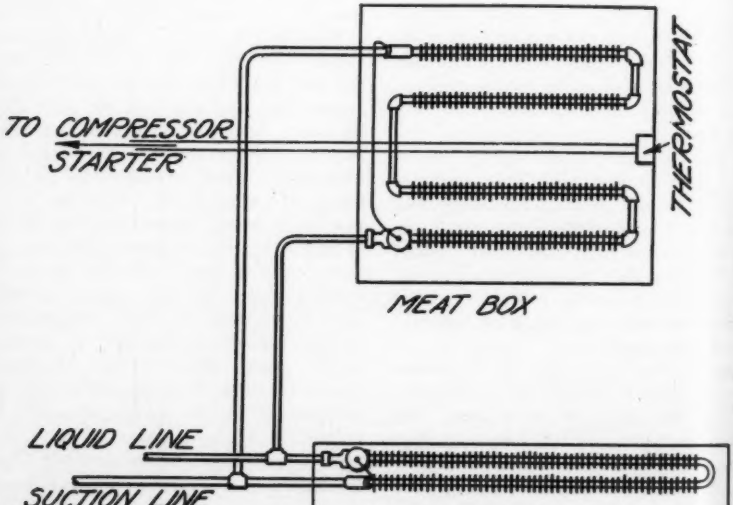


FIG. 2. MEAT COOLER AND DISPLAY COUNTER FED IN PARALLEL BY ONE COMPRESSOR.

less refrigerant is vaporized and the bulbs become cooler. The valves, therefore, close off gradually and only feed enough refrigerant to completely wet the coil surface without permitting any liquor to return to the compressor. Now, when both units are down to temperature, the thermostat in the cooler stops the compressor. During the shut down period no superheat exists since there is no gas velocity and the charge in the remote bulb assumes the same temperature as the refrigerant in the coils. The pressures above and below the diaphragm are the same and the spring closes the valve tightly. The valves then remain closed during the shut down period, eliminating the possibility of spilling excess liquor into the coils which might be pulled back to the compressor when it again starts up.

Now let us assume that an additional load is placed in the cooler; the temperature in the cooler rises and the thermostat starts the compressor. The suction gas at the evaporator outlet immediately becomes superheated and the valve opens. Refrigeration again takes place and the thermo valve maintains a constant superheat at the bulb. As the cooler comes down to temperature, less refrigerant is vaporized, the bulb becomes colder, and the valve closes off some. While the cooler required refrigeration to cool its additional load, the load in the counter may have remained constant and no refrigeration may have been required in that unit. In that case the valve feeding the counter would remain closed since the load was down to temperature and very little refrigerant was being vaporized. However, as soon as refrigeration is required in the counter, regardless of what is taking place in the meat cooler, provided, of course, the compressor is running, the valve opens. In this manner each unit is controlled independently.

How to Tone Up Your Business

In This Article the Third of a Series, the Author Points Out the Importance of Having a Definite Understanding with the Customer Regarding Payments.

By T. J. FOWLER

HOW can I get my customers to pay up promptly? How can I reduce my collection expense? Is there a way to keep my books free of bad debts? These are questions you probably have puzzled over, for they apparently are worrying almost every business man today. Some business men upon investigation have been surprised to find large amounts tied up in old, unpaid accounts—money that they thought "would come in if they gave the debtor time," but which in most instances never materialized.

I believe the greatest trouble is due to lack of a definite understanding with the customer when the account was taken. Taking too much for granted usually is expensive in the long run. It is always hard to satisfy a man that your price is right when he had no idea in the first place what the charge would be. Especially does this apply to the refrigeration service business.

When a refrigerator owner calls you, you diagnose the trouble and tell him approximately what the service will cost. This is the time to collect at least part of the cost of this work, or have a definite understanding regarding how or when you will receive your money. It is advisable in the case of a large job to have a signed contract setting up what you intend to do, the cost of this work, together with terms of payment.

Business men are doing both themselves and their customers an injustice by not demanding regular settlement of accounts; the sooner we muster sand enough to demand what is

* President, Chicago Chapter No. 1, R. S. E. S.

coming to us when it is due, the more money we will make. Doing a big volume of business is of little good if our hard-earned money remains on the wrong side of the ledger.

Similar opinions are expressed and enforced by well organized business institutions, who have found that there are fewer bad debts when a definite understanding regarding payment is arranged before services are rendered.

It is to be understood that some work will be done on open account and some on a modified extended payment plan. Contracts will provide that payment be made with regularity; it is sometimes necessary to take part of money due before work is started, part when work is completed and the balance at some later date that has been decided on. Never neglect to have these arrangements in writing, because it is difficult to enter premises and take part of a refrigerating plant and labor away from a customer once it has been installed.

Itemize Operations

Frequently payment is held up because the customer does not thoroughly understand all about the services performed. To bring about prompt payment it is a good idea to itemize operations performed on your statement setting up the cost figure as one item at bottom of statement. Your customer is like yourself, he wants to know what he is being charged for. Itemizing the account requires little time and minimizes the possibility of "come backs."

Investigating the responsibility of your customers before dealing with them always is wise, business men agree. Witness the experience of two business men. One had $65,000 in old accounts on the books, the other had not a single loss for over two years. What is the secret of the second man's success? He declares it is because he will not do business with any except reliable concerns. He does commercial contracting mainly, and knows most of his customers. If he does not know the prospect, he gets a report on him from a local credit rating agency. This report costs him only fifty cents, and he says no half dollar can be invested more wisely.

Business men and organizations can work together in establishing a local credit agency, and thus defeat the professional bill dodger. For example, in Illinois the business men in 128 towns and cities have organized a credit association. In each city, a local credit association acts as a clearing house for information regarding bad debtors. As a result of information exchanged through a central association, the man who refuses to pay his bill in one town finds it impossible to secure credit from a firm in another town. His record is known.

If he moves to another part of the state, his situation is no easier, for the first question asked by a member of the association in getting facts on which to base credit is "where did you live last?" The customer's record, forwarded from his former place of residence, immediately checks any attempt to do business at the expense of others. The association thereby saves its members from loss and automatically locates the debtor for the benefit of his creditors.

Credit Information

A local association to furnish business men with information similar to commercial agency service can easily be organized, it was found. The dues required to keep one up are low—merely enough to maintain a secretary and office organization is all that is required. Such associations investigate the exact responsibility of every one of the buying population of a town, and when possible, cooperate with firms in nearby towns in order to obtain information concerning new residents. Every member pledges himself, on joining, to extend credit to no one on the delinquent account.

In one instance, business men in an Indiana town began war on sulky debtors by an announcement in the local newspaper outlining the scheme and enumerating the benefits of giving credit only to people entitled to it. Newspaper advertisements demonstrated that the man who defrauds, practically compels honest buyers to make up the loss. These announcements were carefully worded to secure the sympathy and cooperation of the public, and arouse favorable sentiment.

When notes are accepted in lieu of payment, endorse the note and leave it at the

bank for collection. People appear to respect the demands of a bank quicker than the demands of their creditor.

Despite the closest watch of accounts and in spite of the strictest guarding of credit, the business man's judgment will go amiss at times, and accounts will become overdue. What is the best method to collect them? Sending a collector is an effective way, but it is too costly for many one man businesses. But the effective collection letter points a way out.

For collection purposes, debtors may be divided into three general classes—good pay, slow pay and bad pay—and certain types of collection letters are needed to fit each class. It should not be difficult for any one-man business to classify its debtors, because most of its customers are known to its head.

Collection Letters

One business man says: "If you do not know the facts about your debtor, make the collection letter clear the way. Avoid the all too common mistake of showing irritation in your first letter to a debtor. Begin in a friendly, general manner and make the delinquent classify himself by his answer. Then take the proper steps to make him pay up in quick time." One or two form letters filled in will dispel the doubts existing about a debtor and put a definite problem up to you. Your task then narrows downs to that of selecting and presenting the type of appeal which fits the case.

Straight forward talk, teeming with human interest, is the magnet which draws the dollars from the debtors' pockets. When you have classified your debtor, get on his side of the fence and look at the situation through his eyes. Make him feel from your first word that your interests and his are the same. The correspondent who learned that a customer's home has been destroyed by fire and offered an extension of time on an overdue account showed a lively appreciation of his delinquent's troubles and established cordial relations which settled a recurring business worry.

Get the "I'll help you" feeling in your appeal. You will draw big dividends on that small investment. Let your debtor realize that your desires are his desires in a similar situation, and state your case frankly in terms of a square deal. There need be no lack of dignity or firmness. You need no note of apology or humility. But give your appeal life, get in intimate touch with your prospect.

An analysis of proved collection letters shows this "you" interest—the interest of the debtor instead of the collector appearing in dozens of ways, limited only by the skill and experience of the writers, wherever the "you" motive appears, and however it is applied, it can be placed under one of five general divisions: pride, utility, caution, money and self-indulgence. All these are common to humanity, and all human endeavor can be traced to them as causes. Study them and select the form in which you can best apply them to the debtors who worry you.

Obviously, letters must be well written, concise and to the point if they are to secure results. To get across successfully, a collection letter must fulfill the following requirements: First, it must attract attention; second, it must hold interest; third, it must present strong forceful arguments; fourth, it must inspire immediate action.

Getting Attention

It is always wise to keep the man's education and business experience in mind. No letter should be written that the debtor cannot understand. Short, simple words and short sentences are preferable.

With attention won, your next step is more difficult. You have to secure interest and make your client get well into your letter before he realizes he is being dunned. The scheme which you use to compel attention can be used to hold interest, or you can compare the advantage of paying with the disadvantage of not paying. Play up to your customer's interests at this point and forget yours.

By getting the reader's attention, you turn his thoughts from other subjects. When you arouse his interest, you lead his thoughts to mutual affairs. You have, you remember, five classes of appeals to choose from: caution, utility, pride, money and self-indulgence. The classification you have made of your debtor indicates the proper class of appeal to pursue.

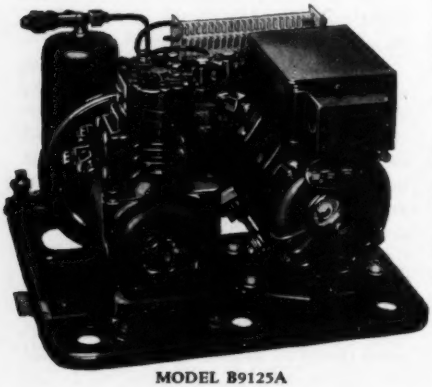
1934 DOMESTIC KELVINATOR CONDENSING UNITS

THE 1934 line of Kelvinator domestic condensing units is similar to the 1933 with the following changes and improvements.

Compressors

The Model A (formerly CA) and Model B (formerly CB) compressors have not been changed.

The Model FB compressor has been replaced for domestic use with the Model G. This new compressor is of similar design and construction to the Model B, except that it is larger, the bore being 1½" and the stroke 1¾".



MODEL B9125A

Float Valve

An entirely new design of high side float valve is used. The new float valve is more simple and, consequently, more rugged. If the float valve must be changed for any reason the float valve and liquid receiver assembly must be removed as a unit, as in the previous models, as the float valve is welded into the liquid receiver and so cannot be serviced.

Liquid Receiver Service Valve

The liquid receiver service valve is now mounted on the float valve body, as seen in the picture. It will also be noted that the service valve is of a different design. However, the same service valve tools are used as used on the other service valves. The liquid receiver service valve is now insulated with a rubber jacket to decrease heat leakage and, hence, increases the efficiency of the system.

Motor Pulleys

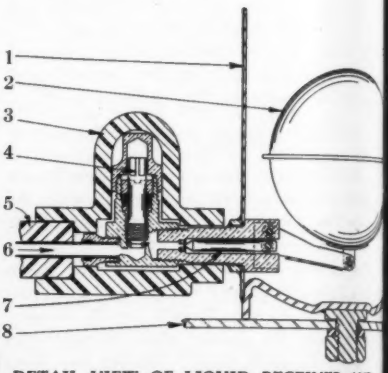
Condenser fan noise is practically eliminated by new type fan blades on the motor pulley.

Condensing Unit Base

The condensing unit base has been redesigned for greater strength.

Condenser

The condenser has been increased in size on certain models.



DETAIL VIEW OF LIQUID RECEIVER AND FLOAT VALVE ASSEMBLY

1. Liquid Receiver
2. Float Valve Float
3. Liquid Receiver Service Valve Insulating Jacket
4. Liquid Receiver Service Valve
5. Liquid Line Insulation
6. Liquid Line
7. Float Valve Valve
8. Condensing Unit Base

MODEL DATA

Model	Part No.	Compressor		Motor H. P.	Overall Dimensions		
		R. P. M.	Kelvinator Oil Charge		W'th.	Depth	Ht.
A9116A	17515	640	1 lb. 3 oz.	1/6			
B9116A	17516	410	1 lb. 10 oz.	1/6			
B9125A	17517	525	1 lb. 10 oz.	¼			
B9133A	17518	640	1 lb. 10 oz.	¼			
G9133A	17571	575	2 lbs.	½			
G9133A	17572	575	2 lbs.	½	29 5/8"	16 3/4"	22 5/8"

John E. Gerth, Jr.

"Enclosed find money order for subscription to THE REFRIGERATION SERVICE ENGINEER. I find it very helpful in keeping up to date in refrigeration."

Heating and Cooling System

Description of a Combination System and Diagrammatic Layout of Installation. Explanation of the Cooling-Heating Unit and Controls.

By JOHN ELLISON

THE diagram on pages 16 and 17 illustrates the operation and installation of a combination cooling and heating system. The cooling and heating medium used is water and this system may be used in any type of building. The refrigerating unit can be located in the boiler room or in a room adjacent to it, and any of the approved refrigerants may be used to cool the water.

The piping should be designed for cooling, and the size of pipes thus selected will usually be found plenty large enough for heating. The cooling-heating unit should also be selected for the cooling requirement. This unit when used for heating will have a greater capacity in B.t.u. than required, but this can be offset by using water at a lower temperature and by reducing the speed of the fan. In rooms where two units are used, one may be used for heating and both for cooling. If only certain rooms are to be cooled, then a cooling-heating unit is placed in those rooms and the other rooms may be heated by the ordinary hot water radiators.

Temperature regulation with water is very simple and easy. By the adjustment of a few valves the whole system may be changed from heating to cooling or vice versa.

The Cooling-Heating Unit

The unit shown in the drawing may be used for the cooling or heating of one room or several rooms, depending on the size of the unit. The water control valve and also the fans are governed by a thermostat, which should be located so as to give an average temperature of the room or rooms. When the temperature gets to a determined point, the thermostat will start or stop (depending on the temperature) the air circulating fans and also close or open the water valve. In installation of this type, the temperature of the rooms will not vary over three degrees.

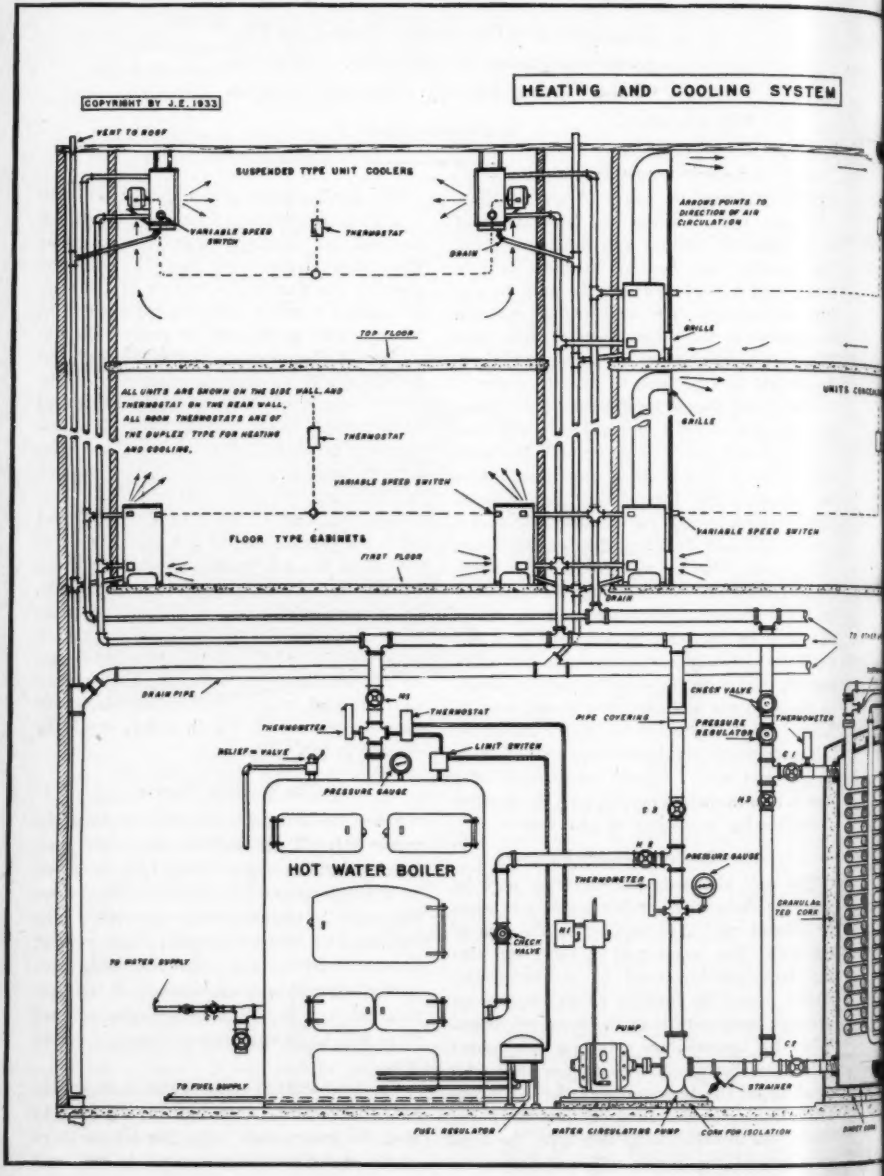
The condensation plates gather the condensation or drippings from the coil when it is used for cooling. Condensation from these plates drains to the pan C.P. and from there to the pan in the bottom of the unit. If wanted, a water spraying system can be incorporated in the unit to control the humidity of the room. Each unit should be provided with an automatic air vent. The outlet velocity of the fans can be controlled by a variable speed switch. The filters remove dust particles from the air and thus a more healthful atmosphere is maintained in the room.

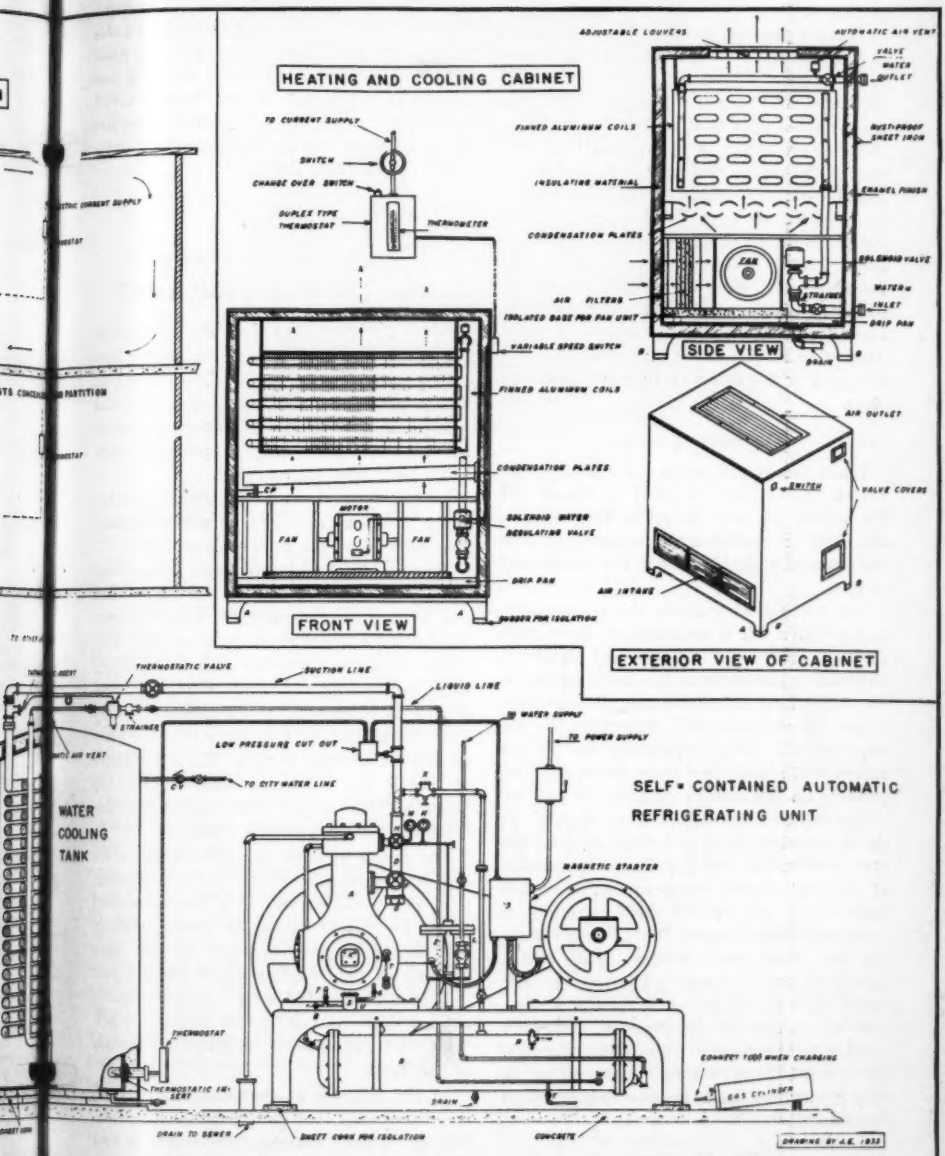
When the units are placed on different floors, a pressure regulator might be connected in the return line so as to be sure of an even flow of water to the highest units. In larger installations a differential pressure regulator should be installed in each main circuit, and the main return line should be run overhead. A balancing tank should also be used, and a float valve which will keep the system filled with water, should be located in this tank.

The Cooling System

When the system is used for cooling, the valves H1, H2, H3 and the switch H1 must be closed. The water in the tank is cooled by a triple cylindrical coil in which the refrigerant is expanded or vaporized. The thermostatic valve supplies the correct amount of refrigerant to this coil. This valve is controlled by the temperature of the suction gas, and it should be adjusted so that there will be no back freezing on the suction line.

The temperature of the water is controlled by a thermostat. It should be adjusted to stop the compressor when the temperature of the water has been lowered to 38°, and when the temperature has risen to 44° the


COPYRIGHT BY J.E. 1933
HEATING AND COOLING SYSTEM
VENT TO ROOF
SUSPENDED TYPE UNIT COOLERS
VARIABLE SPEED SWITCH
THERMOSTAT
DRAIN
ARROWS POINTS TO DIRECTION OF AIR CIRCULATION
TOP FLOOR
GRILLE
ALL UNITS ARE SHOWN ON THE SIDE WALL, AND THERMOSTAT ON THE REAR WALL. ALL ROOM THERMOSTATS ARE OF THE DUPLEX TYPE FOR HEATING AND COOLING.
THERMOSTAT
VARIABLE SPEED SWITCH
FLOOR TYPE CABINETS
FIRST FLOOR
DRAIN PIPE
THERMOSTAT
THERMOMETER
RELIEF VALVE
LIMIT SWITCH
PRESSURE GAUGE
HOT WATER BOILER
TO WATER SUPPLY
TO FUEL SUPPLY
CHECK VALVE
PIPE COVERING
PRESSURE REGULATOR
THERMOMETER
PRESSURE GAUGE
THERMOMETER
CHECK VALVE
PUMP
STRAINER
FUEL REGULATOR
WATER CIRCULATING PUMP
WATER COOLING TANK


HEATING AND COOLING CABINET
ADJUSTABLE LOUVERS
AUTOMATIC AIR VENT
VALVE
WATER OUTLET
TO CURRENT SUPPLY
SWITCH
CHANGE OVER SWITCH
DUPLEX TYPE THERMOSTAT
THERMOMETER
FINNED ALUMINUM COILS
INSULATING MATERIAL
CONDENSATION PLATES
AIR FILTERS
ISOLATED BASE FOR FAN UNIT
VARIABLE SPEED SWITCH
RUST-PROOF SHEET IRON
ENAMEL FINISH
SOLENOID VALVE
STRAINER
WATER INLET
DRIP PAN
DRAIN
SIDE VIEW
FINNED ALUMINUM COILS
CONDENSATION PLATES
MOTOR
FAN
FAN
SOLENOID WATER REGULATING VALVE
DRIP PAN
RUBBER PAD FOR ISOLATION
FRONT VIEW
AIR OUTLET
SWITCH
VALVE COVERS
AIR INTAKE
EXTERIOR VIEW OF CABINET
THERMOSTATIC VALVE
SUCTION LINE
LIQUID LINE
STRAINER
TO WATER SUPPLY
TO POWER SUPPLY
LOW PRESSURE CUT OUT
TO CITY WATER LINE
WATER COOLING TANK
SELF-CONTAINED AUTOMATIC REFRIGERATING UNIT
MAGNETIC STARTER
THERMOSTAT
THERMOSTATIC EXPANSION VALVE
CONNECT HOSE WHEN CHARGING
GAS CYLINDER
DRAIN
DRAIN TO SEWER
SHEET CORK FOR ISOLATION
CONCRETE
DRAWING BY A.E. 1933

compressor should again start. Thus the temperature of the water is kept within a limit of 6°.

The low pressure switch is a safety device. It is connected in series with the thermostat so that either will stop the compressor. If the thermostat should get out of order, then the compressor will keep on running until the pressure switch stops it. A certain pressure of the refrigerant corresponds to a certain temperature; hence this switch should be adjusted to stop the compressor when the temperature of the water has been lowered to 34-35°, thus preventing the water from freezing up. This switch should be provided with a hand reset, which must be reset before the compressor will start again. The refrigerating unit is fully automatic and equipped with all the customary safety devices.

The Heating System

When the system is used for heating the valves C1, C2, and C3 must be closed and the switch H1 must be open. The boiler is automatic in operation and is equipped with the customary safety devices for burning oil or gas.

The thermostat controls the temperature of the water. It is connected in series with the limit switch and with the fuel regulator. In smaller installations the temperature of the water from the boiler may be kept anywhere between 190-150°, depending on the requirement. The temperature rise in the return main will vary from 10 to 25°, depending on the number of units off and on.

The limit switch is a safety device. If the thermostat should get stuck, or for some other reason did not stop the fuel regulator at the determined temperature, then the limit switch will shut off the fuel supply at a temperature of about 200°, thus preventing the water from boiling. This switch should be provided with a hand reset. The relief valve should be set to open at a pressure which exceeds the pressure ordinarily carried in the system. The water circulating pump is kept running continuously. In larger installations a reserve pump should be installed.

Pipe Covering

All pipes should be covered, otherwise they will sweat and there will be considerable refrigeration wasted. Care should be taken to select the right kind of covering. It must stand cold as well as heat, and this also holds good for the cement and paint used on the covering. Cork covering has been found satisfactory for both hot and cold water pipes and also certain combination coverings, which consist mostly of mineral wool and hair felt.

CAPACITOR START INDUCTION RUN MOTORS

THE Emerson capacitor start induction run motor, Figure 1, is one of the new "KS" line of motors now available in 1/8, 1/6, 1/5, 1/4 and 1/3 hp. sizes. This type of motor is ideal for refrigeration service, and other loads where high starting torque and exceptional quietness are essential.

In this type of motor the field or stator has a main and auxiliary or phase winding. The rotor is of the squirrel cage type.

The condenser and outlet box, mounted on the top of the field ring in the illustration, can be furnished separately where desired. It contains a single electrolytic starting condenser connected in series with the auxiliary or phase winding, and in this design the condenser is subjected to approximately only line voltage and the condenser is in use only during the starting period. The low voltage at which the condenser operates on the Emerson "KS" types reduces condenser deterioration to an absolute minimum.

The design of these capacitor start induction run motors is similar to the resistance split phase motor, and at a predetermined speed the cutout opens the phase winding and the motor then operates on the main winding as with resistance split phase types.

They are equipped with a positive, quick acting, single circuit cutout of snap break "contact type" which is essential on motors of this type.

In the diagram of connections, Figure 2, it will be noted that two phase leads, identified by "green" covering, are available and direction of rotation can be readily reversed by interchanging these two phase leads to

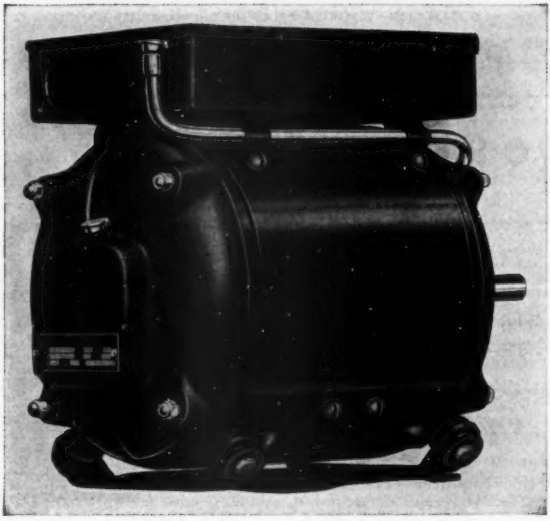


FIG. 1. EMERSON CAPACITOR START INDUCTION RUN MOTOR

the main leads identified by the "black" covering.

The Emerson "KS" motors have condenser mounted in a separate container or box which also serves as an outlet box with "knockouts" for attaching conduit. Condenser life is shortened when condensers are exposed to high temperatures and consequently external mounting of condenser on Emerson motors is conductive to long life and permits easy and rapid replacement of condenser in event of failure.

These motors are built in frames having formed steel rings and cast iron end covers. Both covers of these "KS" motors are equipped with steel shell, babbitt lined bearings with oil grooves in the babbitt lining and having an overflow oil return on the inside of bearing housing. Shaft diameter through the bearings is $\frac{5}{8}$ inch and both bearings are $1\frac{3}{8}$ inches long. Both bearings have large, over-sized oil reservoirs, packed with wool and a cotton wick leads the lubricant from the reservoirs directly to the bearing surfaces.

The wool packed in the reservoirs at the factory is saturated with solidified oil, which cannot spill out during shipment or handling and this factory lubrication is sufficient for at least 3,000 hours of service—more than a year's supply at 8 hours per day. A thorough lubrication of the bearings once a year is sufficient.

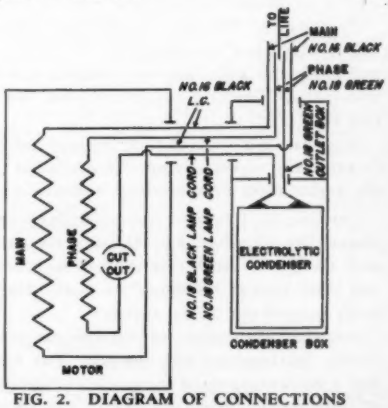


FIG. 2. DIAGRAM OF CONNECTIONS

Bearings should seldom require replacement—with just ordinary attention many years of service will be obtained with little or no wear on the bearings. However, in the event of necessity of replacement of bearings, the old bearings can be pressed out of the covers and new bearings inserted —new bearings must then be reamed to size.

THE Question BOX

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box" which will be answered by competent authorities.

THE following questions are from the Question Box of Chicago Chapter, Refrigeration Service Engineers' Society, and are answered by Mr. Clarence E. Hamilton, chairman of the Educational Committee:

Question 34. Is the Servel high side float an intermittent or a continuous flow float?

ANSWER. A very old model Servel unit used an intermittent float. Later models used a continuous flow type.

Question 35. We have an old type Kelvinator, which has an expansion valve on it, and lately this valve has been making a terrible noise. What can we do to quiet down this valve?

ANSWER. We suggest that the only satisfactory way of remedying this condition is the replacement of valve with a new valve.

Question 36. I have an Iriquois sixth horsepower, low side float job. What is the correct charge of ethyl chloride? How much and what kind of oil should be used? How is air purged out of the system?

ANSWER. The correct charge for this particular job is about nine pounds. You will find a lubricating oil of the grade of "Moboil B" satisfactory, using one quart. The air is purged at the top of the condenser. You will find two valves, one for the purging air and the other for oil.

Question 37. How would the proper setting of a thermostatic expansion valve on a commercial coil using methyl chloride be determined? Service man allowed one hour's time; time required to get the box down to temperature 3 hours; job warm and just started up.

ANSWER. The thermostatic expansion valve remains open until the refrigerant has reached the point at which the bulb is in contact with the suction line. The valves are set for a 12° F. superheat, hence, the temperature of the coil at the bulb will only have to be pulled down to within 12° F. of the cutting off temperature. The coil will reach this temperature quite rapidly. It is comparatively easy to determine when the liquid is approaching the bulb of the thermal valve by holding the suction tube tightly. When the liquid comes in contact with that portion of the tube held by the hand, it immediately drops in temperature. This temperature drop should immediately close off the valve.

Questions Submitted for General Discussion

The following questions were submitted for general discussion at a recent meeting of the Greater Chicago Chapter of the R. S. E. S. Like the story of the "Lady and the Tiger," I am leaving it up to you to answer these questions for yourself as any answer by me would be merely one of personal opinion. (*C. E. H.*)

Question 1. What will the refrigeration business be in 5 years. (1939)?

Question 2. Will the hermetic machine sweep the Industry for household use in the future?

Question 3. What will become of the many multiple systems in coming years?

Question 4. What sort of commercial machine will be used in years to come?

If any of the readers of the REFRIGERATION SERVICE ENGINEER desire to express an opinion on these developments, please send them on.

* * *

John F. Cullyford
Colorado

"Please send me a binder for my copies of THE REFRIGERATION SERVICE ENGINEER, for which is enclosed $1.00. I have been a subscriber since the very first issue and would not think of giving up my subscription as there is valuable information within its covers. I am indeed pleased with the work of the publishers and editor in getting up such a fine trade magazine."

SERVICE POINTERS

Readers are invited to send descriptions of "kinks" which they have found to be of practical help in their every day work. Just send your idea or sketch in the rough, which will be prepared for publication. All contributors' names will be printed. Address the "Kinks" Editor, REFRIGERATION SERVICE ENGINEER, 433 N. Waller Ave., Chicago.

INFORMATION AND CORRECTIONS RELATING TO FREON AND F-114

THE following communication to THE REFRIGERATION SERVICE ENGINEER was received from Mr. R. F. Thompson, refrigeration engineer of Kinetic Chemicals, Inc., Wilmington, Del., correcting some data which has been published in past issues of THE REFRIGERATION SERVICE ENGINEER, and furnishing additional information covering the refrigerants, Freon and F-114:

"In June, 1933, on page 9, 'Pipe Thread Dope,' the statement is made that white lead and shellac are now being used instead of litharge and glycerin. When using the refrigerant Freon we recommend only the use of litharge and glycerin for threaded connections, assuming of course that all threads are well formed and properly chased and that all thread cutting oil had been removed before applying the thread paste. Threaded connections are only as good as the joint is made and assembled.

"In June, 1933, on page 10, a chart is shown of operating head pressures when using Freon. It appears that the head pressures are too low for operating head pressures or too high for pressures on the high side of the system when making pressure readings to determine the presence of air or non-condensables. It may be that the figures which you show are the standing pressures on the high side of the water cooled compressor, assuming that the room temperature is 10° higher than the condensing water temperature. If that is the case, an explanation should be made that will clarify this point. We refer you to the chart shown below:

Freon Water Cooled Condenser

CONDENSER WATER	PRESSURE—POUNDS GAGE WHEN USING FREON		
Temp. ° F	*As Shown*	*Operating*	*Standing*
50°	58 lbs.	71 lbs.	47 lbs.
60	70	85	58
70	84	100	70
80	97	114	84
90	117	128	100
100	136	142	117

"In September, 1933, on page 17, it is stated that it would seem desirable to wear a mask when handling Freon. It is not necessary to wear a mask as concentrations up to at least 20% by volume (63 lbs. of liquid per 1,000 cu.ft. of space) for durations of exposure of the order of two hours will not produce a physiological action. It is true that Freon, when released in large quantities in a small, confined space, may reduce the oxygen content of the room or space to a point which may border on suffocation, but in that case no mask will be satisfactory. We recommend the use of large lensed spectacles to afford protection to the eyes as liquid Freon, coming in contact with moisture in the eyes, may cause injury due to freezing.

"In October, 1933, on page 21, mention is made of F-14 with a formula $C_2Cl_2F_3$. F-14 is tetrafluoromethane (CF_4), which we have never produced commercially as sales for such a product are limited due to the low boiling point and high pressures. F-114 is dichlorotetrafluoroethane, which has the chemical formula $C_2Cl_2F_4$. Freon is dichlorodifluoromethane, sometimes called F-12, and has the chemical formula CCl_2F_2.

"In December, 1933, on page 27, the first refrigerant listed in the table is shown as dichlorodifluoromethane, which should be dichloromethane, or Carrene.

"We realize the considerable interest that the safe refrigerants Freon and F-114 are creating and that their extensive use requires information to be broadcast to refrigeration service engineers."

NEW TROUBLE CHART

By **HERBERT HERKIMER**

IN the January, 1934, issue, on page 18, Question 29 appearing in the Question Box, is an inquiry as follows: How can you determine when the frost back is the result of leaking float valves and when the result of a gas shortage? The answer as given is to see the trouble and complaint charts published in THE REFRIGERATION SERVICE ENGINEER—June to November issues. The trouble chart was published only in the June

issue, and complaint charts have appeared in June and in each issue including this number.

The question as given is rather vague, and should be amplified by the following:

1. In the first place, is the float valve a high pressure float valve, or a low pressure float valve?
2. There is never any frost back due to the shortage of gas in either a high pressure float, or a low pressure float on a single evaporator with a proper designed float baffle or return tube.

Possibly, the correspondent is desirous of knowing the change in the back pressure on either of the float systems, due to loss of gas, which is a definite question and more to the point.

Referring to the trouble chart in the June issue, it is stated that with a shortage of refrigerant, the back pressure remains normal or lower. As an actual fact, in case of a low pressure float the pressure may go higher especially with sulphur dioxide but with all other systems, even with a direct expansion system, the back pressure will go lower with an undercharge. My new trouble chart gives the low pressure float effect.

Frost Backs

Now, in regard to frost backs. A frost back will occur with too large an orifice or leaky float on the high pressure float or low pressure float system. You will also get a frost back with a high pressure float due to an overcharge, also with an overcharged capillary tube which you will not get with a low pressure float.

The trouble chart which I compiled for the June issue is supposed to cover generally all makes. However, the new trouble chart I have compiled goes a little more into detail especially in regard to the capillary tube system. There have been two types of conventional capillary tube systems on the market.

1. The Rice Methyl Chloride Capillary Tube System which has a receiver.
2. The Crosley Type Capillary Tube System which has no receiver.

Referring to the new trouble chart M-3 revised December, it will be noted that if the capillary tube or orifice is stopped up and the system is equipped with a receiver (Rice system) the back pressure will become lower and the head pressure will become lower; while to the contrary if the capillary tube system is not equipped with a receiver (Crosley system) and the tube becomes stopped up or the liquid line becomes stopped up, the head pressure will go extremely high; also the back pressure will go higher. The same effect will be noted with a high pressure float system that is not equipped with a receiver, i.e., the old Servel high pressure float system.

If the high pressure float sticks shut without a receiver, the head pressure will go very high and will be followed by the back pressure, and to the contrary, if the high pressure float system is equipped with a receiver and the high pressure float sticks shut, the back pressure will become lower and the head pressure will become lower.

Development of Trouble Chart

This new trouble chart covers any situation and also mentions in the lower right hand corner that an overcharge high side float or capillary tube gives frost back on suction.

It possibly will be of interest to service men to know the development of these trouble charts, because they are associated with the growth of the industry. The first trouble chart was compiled by the writer in 1925. Troubles of yesterday are the troubles of today and tomorrow, and this new trouble chart simply re-arranges the effects. The refrigerating industry is a growing industry, and the art or science of servicing develops accordingly. As the number of refrigerators increase, the demands upon the service men are increasing proportionately. The service man who turned in a few repairs a day ten years ago, is expected today to turn in many more jobs daily.

The service man today must better systematize his method of observing the *effects* of trouble, listed 1 to 9 on TROUBLE CHART. At the same time he should improve his system of diagnosis of *trouble*. The writer suggests the routine of A to F listed in the TROUBLE CHART.

TROUBLE CHART

Revised December, 1933

		Check Causes in Following Order ↓ TROUBLE Make Observations In Following Order →	1 Frost	2 Refrigeration	3 Liquid Line	4 Compressor Feel Top	5 Compressor Jumpy?	6 Orifice Noise	7 Back Pressure	8 Head Pressure	9 Cycle
Circulating Troubles	Major A	Orifice too small— (A) Stuck Shut Float Needle (B) Stuck Shut Exp. Valve Needle (C) Closed Receiver Valve (D) Plugged Strainer (E) Plugged Liquid Line (dirt, ice) (F) Closed Suction Stop Valve (G) Rate of Liquid Flow too Small	Slight or None	Bad	Normal	Cooler	Normal	Quiet	Lower With Receiver — Higher Without Receiver	Lower with— Higher Without Receiver	Short with Pressure Switch — Long On With Thermostat Switch
	Major B	Inefficient Compressor— (A) Bad Compressor Discharge Valve (B) Bad Piston Rings—2 cyl. Split Gasket (C) Bad Compressor Suction Valve	Slight or None	Bad	Cooler	Cooler	Normal	Gurgle	High on Off-Cycle	Lower	Long On Short Off
	Major C	Undercharge (A) Leaky Seal (B) Leaky Joints (C) Careless in Charging	Slight or None	Bad	Warm	Cooler	Normal	Hissing	Lower Except Low Side Float	Lower	Long On— But with Press Con. High Press' Float—Short
	Minor D	Air in System (A) Leaky Seal (B) Neglect in Purging	Normal with Full Charge	Normal Unless Excess	Warm	Hot	Yes	Gurgle	Normal	High	Long On Short Off
	Minor E	Orifice too Large (A) Stuck Open Float Needle (B) Stuck Open Exp. Valve Needle (C) Rate of Liquid Flow Excessive	Suction Line May Frost Up*	Poor	Warm	Hot	Yes	Gurgle	High	High	Continuous Or Long On
	Minor F	Overcharge (A) Careless in Charging	Normal	Normal Unless Great Excess	Warm	Hot	Very	Gurgle	Normal	High	Longer-On Shorter Off
Control Troubles	G	(A) Thermostat Bulb too far from cold spot (B) Pressure Switch set too low cut-out	More	Very Cold	Normal	Normal	Normal		Normal or Lower	Normal	Continuous or Very Long
	H	(A) Thermostat Bulb at too cold a spot (B) Pressure Switch set too high cut-out (C) Unit does not run long enough time.	Slight Frost	Poor	Normal	Normal	Normal		Normal	Normal	Short On Short Off

COPYRIGHTED—HERKIMER INSTITUTE OF REFRIGERATION, N. Y.

*Note. Overcharged high side float or capillary tube gives frost back on suction.

Cut out along outer line and insert in binder for ready reference.

FOR LEATHER BINDER WRITE TO H. T. McDERMOTT, SECRETARY REFRIGERATION SERVICE ENGINEERS' SOCIETY
433 N. WALLER AVE., CHICAGO, ILL.

NEW MECHANICAL DEVICES
Service Tools and Special Equipment

Under this heading there will be published illustrated descriptions of new or improved service tools and equipment for the Service Engineer.

RESURFACING COMMUTATORS

THE Ideal Resurfacer, manufactured by the Ideal Commutator Dresser Co., Sycamore, Ill., permits the service engineer to true commutators without the dismantling of motors or shutting down of refrigerator service. Motors with rough or dirty commutators cause abnormal brush wear or inefficiency. No doubt it has been found practically impossible to apply sandpaper to a commutator evenly and firmly, as is necessary for a satisfactory job.

RESURFACING MOTOR COMMUTATOR.

The Ideal Resurfacer, which is a pencil-type commutator dressing stone, is made in various grades—coarse, medium, finish and polish. They are convenient size, 3/8"x5/8"x 6". The Ideal Commutator Dresser is simple to use, and it is necessary to see that the commutator is clean; if oily or greasy, place a cloth over the tool and wipe off the commutator. The finish stone is used to cut down high mica and true the commutator smoothness, which will insure good operation.

This simple method of resurfacing commutators on the job will avoid brush replacements in many instances, and has been used in the service departments of the leading refrigerator manufacturers, who have enthusiastically indorsed it for the use of their service departments.

S S S

AUTOMATIC DEFROSTING

A NEW device has been recently manufactured under the trade name of "Frostoff" which consists of a self-starting synchronous motor, clock and a relay, which stops the flow of current to the domestic refrigerator, permitting defrosting daily without melting the ice cubes or permitting the temperature of the refrigerator to raise over 4°. The apparatus, which is entirely automatic after once installed, and which can be used with any make of electrical refrigerator, is adjustable to either 110 or 60 cycle current.

It is claimed by the manufacturers that "Frostoff" will reduce the operating costs in keeping the evaporator clean of frost, and as a consequence, there is no refrigeration effect lost through ice coated evaporators. The makers also claim that the daily defrosting eliminates "frozen-in" ice trays.

The "Frostoff" device is plugged into the house current, and in turn, the refrigerator lead wire plugged into the "Frostoff."

This device has been approved by the Underwriters' Laboratory, and is furnished in bakelite case in white enamel, and is claimed after once installed, eliminates any attention or shut-down for extended defrosting.

S S S

C. L. Evans
Mississippi

"Please find enclosed check for subscription to THE REFRIGERATION SERVICE ENGINEER. I think the magazine is a mighty good one."

CHART NO. 10

Nominal Size O. D.	Wall Thickness	SO_2 Lbs. Ft. Liquid Line	Inside Dia.	Weight Lbs. per Ft.	Feet Per Lb.	Cubic Inches per Ft.	Length in Ft. per Sq. Ft. Exterior Area	SO_2 lbs. Ft. Exp. Coil
1/4"	.035"	0.0152	.18"	.092	11	.035	15	0.004
3/8"	.035"	0.0438	.305"	.145	7	.876	10	0.1
1/2"	.035"	0.0871	.43"	.198	5	1.76	8	0.022
5/8"	.035"	.....	.555"	.225	4	2.90	6 1/2	0.036

O. D.=outside diameter. Tubes are classified according to outside diameter, while pipes according to inside diameter.

PIPE DATA

TABLE 5-19
STEEL PIPE (STANDARD WEIGHT)

Nominal Size	Actual O. D.	Inside Diam.	Minimum Diam. Bend	Weight per Foot	Cu. Inches per Ft.	SO_2 Lbs. per Foot Exp. Coil
3/8"	.675"	.493"	2.75"**	.567 lbs.	2.31	.028
1/2"	.840"	.622"	3.0"**	.850 lbs.	3.60	.045
3/4"	1.050"	.824"	3.75"**	1.130 lbs.	6.4	.080
1"	1.315"	1.049"	4.0"**	1.678 lbs.	10.4	.130
1 1/4"	1.660"	1.380"	4.5"**	2.272 lbs.	18.0	.225

COPYRIGHTED—HERKIMER INSTITUTE OF REFRIGERATION, N. Y.

10

Cut out along outer line and insert in binder for ready reference.

FOR LEATHER BINDER WRITE TO H. T. McDERMOTT, SECRETARY REFRIGERATION SERVICE ENGINEERS' SOCIETY
433 N. WALLER AVE., CHICAGO, ILL.

The REFRIGERATION SERVICE ENGINEER

A Monthly Illustrated Journal, Devoted to the Interests of the Engineer Servicing Refrigeration Units, Oil Burners and other Household Equipment.

Vol. 2 March, 1934 No. 3

RATES OF SUBSCRIPTION
In Advance, Postage Paid
UNITED STATES - - - - - - - - $2.00 a year
ALL OTHER COUNTRIES - - - - $3.00 a year
Single copies, 25 cents

Advertising rates on application. Make remittances by postoffice or express money orders, international money orders, checks or drafts on Chicago or New York, payable to Nickerson & Collins Co., Publishers.

NICKERSON & COLLINS CO., *Publishers*
General Office.....433 N. Waller Ave., Chicago
Telephone Austin 1303, 1304 and 1305
Eastern Office.....149 Broadway, New York City
Telephone Barclay 7-8275

Official Organ
REFRIGERATION SERVICE ENGINEERS' SOCIETY

SYSTEMATIZED SERVICING

THE service man is not only to be considered a "trouble shooter," but among his many qualifications he should know the proper approach to the householder in answering a service call. This approach, in the final analysis, is an important part of his salesmanship. The purchaser of refrigeration servicing is a discriminating individual, and many types will be encountered in a day's servicing work.

Experienced service men recognize the importance of this customer approach, and they realize that their method of procedure in correcting service difficulties will go a long way in maintaining customer satisfaction.

In talking, a short time ago, with an experienced and qualified service man, he suggested that in determining mechanical difficulties, the service man should proceed somewhat along the following line.

1—The service man should open the door of the refrigerator and examine the frost.

2—Examine the refrigeration, ice cubes, odors, perhaps questioning the user.

3—Feel the liquid line; it may give information.

4—Feel the top of the compressor or condenser.

5—Is the compressor "jumpy?"

Now all of this preliminary analysis has been done in a systematic method, requiring a very few minutes, without the necessity of even opening the tool kit. In further analyzing possible complaints, the method of procedure would be somewhat as follows:

6—The compound gauge should be inserted. This is a recommended practice and determines if the compressor is actually working. It only takes a few minutes and saves considerable trouble.

7—The head pressure gauge is now suggested, although many service men at this point do not find it necessary to install a head pressure gauge.

8—The operating cycle of the machine is observed, making note of temperature pressure, time of operation and shutdown.

This service man stated that, while this exact sequence of operation may not be desirable in every case, nevertheless it serves as a good basis for systematizing the service call. it is found, also, that the systematized service call has been instrumental in increasing the number of calls which he has been able to make in a day.

DEVELOPING BUSINESS

WITH the advent of spring, service organizations will look for the expected increase in business, which normally occurs at this time of the year.

Advertising promotional campaigns have been used successfully by service companies in acquainting community prospects with their service, and from time to time the editorial department of THE REFRIGERATION SERVICE ENGINEER will outline some of the methods which have been used.

In making a service call, it should be the policy of the service company to leave some form of identity which the householder may conveniently find when future service may be required. Probably the most practical is a small sticker with the name, location and 'phone number of the service company, which can be placed inside of the refrigerator.

One service company has found that it pays to make a personal canvass of their neighborhood and, if permitted, place a sticker on the inside of the refrigerator door.

REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; with special reference to servicing and installation of domestic and small commercial equipment; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

ASSOCIATION HEADQUARTERS: 433-435 North Waller Ave., CHICAGO, ILL.

MEETINGS OF CHAPTERS

St. Louis Chapter

Meeting of February 8

MR. A. JEROME ROBINS, president of St. Louis Chapter, called the meeting to order at 8:15 p. m. at the David Ranken Jr. School of Mechanical Trades, with forty-seven service men present.

For the benefit of those who were not present at the previous meeting, Mr. Robins again explained briefly the purposes and objects of the Society, and a short recess was called to enable those who desired to sign the petition for charter and to fill in their applications for membership to do so.

Mr. A. Gass offered a motion, seconded by Mr. J. D. Gray, which was unanimously adopted that "the president of St. Louis Chapter be empowered to appoint such committees and committee chairmen to begin the work for which the Society is organized."

Mr. Robins announced the appointment of the Educational Committee as follows: J. A. Link, L. Grassinger, L. G. Klingel, J. H. McDowell and E. A. Plesskott, chairman.

A committee of four was also appointed, who will be responsible for the Question Box, namely: C. Brooks, Wm. Bagley, J. Uhl and J. D. Gray, chairman. This committee will be responsible for answering any questions deposited in the Question Box.

A committee was appointed, consisting of W. H. Dieckman, Geo. W. Smith, E. A. Plesskott and A. Jerome Robins, to consider the suggested Constitution and By-Laws for local chapters, as provided by the National Secretary's office, and to report its findings as soon as possible.

For the guidance of the Educational Committee, a request was made to determine what subject would be of interest to the greatest number, and it was suggested by Mr. Gray that for the time being St. Louis Chapter secure such material from its own members. This suggestion seemed to meet with general approval.

Meeting of February 22

President Robins called the St. Louis Chapter meeting to order at 8:15, at the Coronado Hotel, with fifty-five in attendance, and the minutes of the previous meeting were read and approved.

It was decided to establish a plan whereby a waiver of approval and a vote on the minutes would save time for the business of the chapter. The reports of the Educational Committee and the Question Box Committee were given. The Committee on By-Laws reported that the proposed Constitution and By-Laws was still under consideration and that they hoped to have their recommendations, if any, ready at an early date.

Mr. Sam Kennard III, a former member-at-large of the Society, who was recently transferred to St. Louis Chapter, was introduced and called upon for a few remarks.

He described his visits to New York and Chicago Chapters.

At the request of several members, a reading of service pointers on the subject of "Oil Logging in Float Jobs" was made from the official organ, which resulted in a lively discussion, and some good additional kinks were given by Messrs. Meyer, Grassinger, Klingel, Convey and Pennington.

Mr. Robert Wiecker, of the Brown Supply Co., was introduced and gave a comprehensive talk on the "Grunow." He promised that he would be prepared to go into the subject of service in detail with the help of a Grunow demonstrator whenever the chapter requested it.

Mr. H. L. Dahm, technical director and vice-president of the G. S. Robins & Co., was introduced and spoke briefly. He promised in the near future to exhibit a film on the dehydration of SO_2 and give a lecture on the toxicity of the various refrigerants in common use.

Mr. O. G. Tinkey, designing engineer of The Curtis Mfg. Co., was introduced and responded with a few remarks on the enormous future of air conditioning for the refrigeration service engineer.

It was the consensus of opinion that a committee be appointed to secure figures for an evening of entertainment for the night of the charter presentation, and President Robins appointed T. A. Brenner and V. E. Schaefering to secure all data and report March 8.

An Exchange Department was also established, and Mr. Schaefering volunteered to serve for the time being.

Northern New Jersey Chapter No. 1

Meeting of February 7

THE meeting was called to order with President J. C. Hummelt presiding, and the minutes of the last meeting were read and approved. The regular routine business was disposed of, and on motion of Mr. Spinosa, it was decided to have a social on February 28. The secretary was instructed to notify the members accordingly and urge them to invite all service men to participate in this evening's entertainment, and to urge them to join Northern New Jersey Chapter.

President Hummelt then gave an informal talk on the servicing of commercial units, referring particularly to the Zero Plate.

Detroit Chapter

ELECTION of new officers was held by Detroit Chapter, which resulted as follows:

President—James H. Downs, The Downs Service.

1st Vice-President—Paul Mercer, Square Deal Electric Service.

2nd Vice-President—Charles Abel, United Refrigeration Service.

Secretary-Treasurer—J. M. Oberc, Refrigeration Accessory & Supply Co.

Mr. Geo. H. Clark, Mercier & Clark, Inc., was appointed chairman of the Educational Committee.

The new officers elected for Detroit Chapter have been long engaged in and associated with refrigeration servicing business locally, and are making plans for a most progressive chapter in Detroit.

Chicago Chapter No. 1

Meeting of February 13

AFTER disposing of the usual business of the chapter, President Fowler turned the meeting over to Mr. C. E. Hamilton, chairman of the Educational Committee, who announced that the educational activities of the evening would be conducted by the members of Chicago Chapter.

Mr. R. L. Hendrickson, second vice-president of the chapter, gave an interesting discussion on the construction and servicing of the Servel machine, and President Fowler talked on various phases of refrigeration servicing, illustrating some interesting points on various short cuts in servicing work that he had found practical. Mr. Ivar Skipple, who has had considerable experience on ammonia work, contributed much to the success of the educational activities of the meeting, with an interesting discussion of this particular type of refrigerating unit.

CHICAGO CHAPTER RECEIVES ITS CHARTER

FOR several months previous to Feb. 23rd, the evening of the first annual banquet and entertainment of Chicago Chapter, arranged in conjunction with the presentation of the charter, the various committees which had been appointed, were busy with the preparations for this eventful night, which will long be remembered, and the work of Mr. George Monjian, chairman of the Entertainment Committee, and Mr. H. J. DeGan, chairman of the Ticket Committee, was well rewarded by the splendid evening's festivities.

About 150 members and guests sat down promptly at 8:00 o'clock to partake of the banquet, which was arranged in the Bal Tabarin of the Hotel Sherman, one of the foremost entertainment centers in the city of Chicago.

The festivities of the evening were started by community singing, and during the dinner several acts of entertainment were arranged for the enjoyment of those present.

President Fowler, in welcoming the members and guests, announced that Mr. Carl E. Buddenbaum, a prominent Chicago attorney, would act as Master of Ceremonies, and he introduced in turn the officers of Chicago Chapter, as well as the chairmen of the committees responsible for the arrangement of Charter Night.

At the conclusion of the banquet, Mr. Buddenbaum introduced Mr. H. T. McDermott, National Secretary, who gave a brief address preceding the actual presentation of the charter and the obligating of the members of Chicago Chapter.

The Chicago Committee had promised that speech making and other business would be kept to the minimum, so that the greater part of the evening could be devoted to entertainment, and as a consequence those present had several hours of enjoyable fun. The important feature of the evening's entertainment was the arrival of King Cole and his court, and apparently the King was no easy master to serve, as he had many service men brought to trial and sentenced accordingly, depending upon the extent of their errors in servicing work. The trial of the several culprits was interspersed with entertainment that the King ordered. The cast participating in the presentation of this feature of the evening included practically all members of Chicago Chapter.

The entertainment of the evening was made possible through the splendid cooperation and assistance of various individuals and firms, who contributed toward defraying expense for this occasion. Acknowledgment of Chicago Chapter is made to the following:

Harry Alter & Co., 1423 S. Michigan Ave.

Gates Co., Belting Dept., 1524 S. Western Ave.

L. H. Gilmer Co., Belting Dept., 665 W. Washington.

Gustav Lidseen, 832 S. Central Ave.

Fedders Manufacturing Co., 603 W. Washington Blvd.

SPEAKERS' TABLE AT CHICAGO CHAPTER CHARTER PRESENTATION.
Left to Right: George Monjian, R. B. Vanston, H. J. DeGan, R. L. Hendrickson, Carl E. Buddenbaum, Thomas J. Fowler, H. T. McDermott, C. E. Hamilton, F. W. Kap, J. S. Northcote.

OLD KING COLE AND HIS COURT AT CHICAGO CHAPTER'S BANQUET.

Kerotest Mfg. Co., 1844 W. Lake St.

U. S. Gauge Co., 804 Washington Blvd.

Chemical Distributors, 365 E. Illinois St.

Standard Refrigeration Parts Co., 5101 W. Madison St.

George Monjian Co., 360 E. Grand Ave.

Henry Valve Co., 1019 N. Spaulding Ave.

Rempe Co., 340 Sacramento Ave.

Nickerson & Collins Co., 435 N. Waller Ave.

Meeting of February 27

The first annual meeting of Chicago Chapter was called to order at 8:30 p. m., President T. J. Fowler presiding, and the minutes of the meeting of February 13 were read and approved.

Correspondence, enclosing donations for the annual banquet, were read, and a motion was made and seconded that a letter of thanks be sent to each individual subscriber to the entertainment fund.

In proceeding with the business of the annual meeting, the annual report of the secretary was read, as well as that of the treasurer, and also the report of the Auditing Committee, which reports were accepted and filed.

Following the disposition of these reports, the next order of business was the selection of permanent officers, and President T. J. Fowler requested National Secretary H. T. McDermott to assume the chair during the election of officers.

It was the unanimous opinion of those present that, in appreciation of the splendid work which the officers had accomplished during their term as temporary officers during the formative period of Chicago Chapter, all of the officers should be re-elected to serve in their respective positions, and as a consequence the following officers were re-elected to serve as permanent officers for the current year of 1934:

President—T. J. Fowler.

First Vice-President—R. B. Vanston.

Second Vice-President—R. L. Hendrickson.

Treasurer—H. J. DeGan.

Sergeant-at-Arms—J. S. Northcote.

Chairman of Educational Committee—C. E. Hamilton.

In the absence of the secretary, it was moved and seconded that the election for secretary be deferred until the next regular meeting, which motion was unanimously carried.

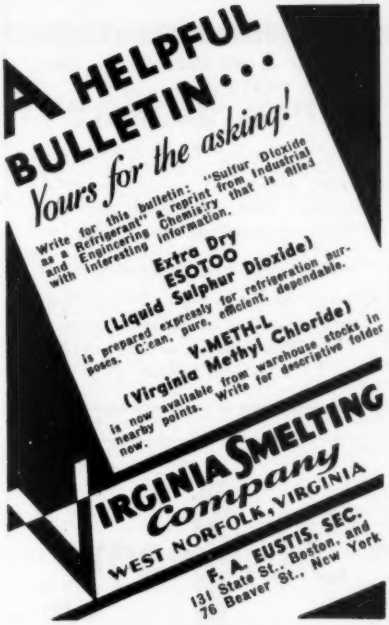
It was proposed and unanimously carried that a rising vote of thanks be given to Mr. J. F. Nickerson and his associates for the work that they have done in the formation of Chicago Chapter, and on motion, regularly made and seconded Mr. Nickerson was unanimously elected as the first Honorary Member of Greater Chicago Chapter.

As an expression of appreciation for the work of the individuals in the success of the banquet and entertainment of Chicago Chapter on Charter Night, a rising vote of thanks was extended to Messrs. George Monjian, H. J. DeGan, R. B. Vanston, J. S. Northcote, Peter Stein, Paul Jacobsen, Henry Seidenbecher, Carl Buddenbaum and T. J. Fowler.

A short discussion was given by Mr. Hamilton as to his plans for the educational activities of Chicago Chapter during the coming year, and he also called on several members for comments on various servicing problems, including Messrs. Vanston and Quiram.

CORRECTION

IN the report of formation of St. Louis Chapter in the February issue, page 26, a transposition occurred in the names of two of the officers. Mr. L. Vollman, treasurer of St. Louis Chapter, is pictured in the center, while Mr. E. A. Plesskott is at the extreme right.



SUPPLIES — PARTS —
COILS — CHEMICALS —
MATERIALS — UNITS

REFRIGERATION SPECIALTIES
"With Estimating Service for Service Engineers"

SERVICEMEN SUPPLY CO.
1819 Broadway, NEW YORK CITY

REPLACEMENT PARTS
For Frigidaires

Eccentrics—Connecting Rods—
Shafts—Pistons—Pins—Rings—
Gaskets—Flapper Blades and Discs
also
Gaskets for Kelvinator and Servel.

ALL GASES—BELTS—TUBING—FITTINGS—TOOLS

Iceless Refrigeration Accessories Co.
2401-15 Chestnut Street, Philadelphia, Pa.

Instantly Locate
the slightest leak with a
TURNER HALIDE DETECTOR

It will positively detect leakage of ANY Chlorinated Hydrocarbon Refrigerant. Its construction permits testing of otherwise inaccessible joints.

The Turner Halide Detector is indispensable to service men—it is easily carried and operated—extremely sensitive—absolutely dependable—approved and used by leading refrigeration manufacturers.

Write for Catalog S-3 and Prices.

THE TURNER BRASS WORKS, Sycamore, Illinois

Herkimer Institute

"Makers of All-Make Service Men"

1819 Broadway
New York City

"A Practical Trade School"

New models and new refrigerants do not up-set service departments manned by "Herkimer trained" service mechanics.

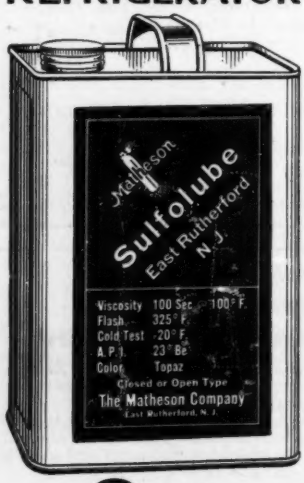
Competent men available for all localities.

Dealers, Service Managers, Manufacturers, when in need of reliable service men—
Write, phone or wire—
no obligations.

The Matheson Co.

East Rutherford, N. J.

REFRIGERATOR

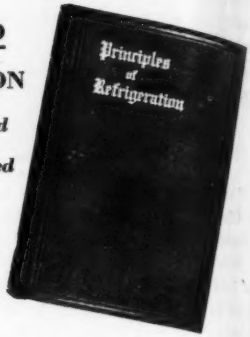


— OILS —

A Complete
Library on Refrigeration
IN ONE VOLUME

PRINCIPLES *of* REFRIGERATION

3RD EDITION
Revised and Enlarged



The work is in everyday language, and as free as possible from higher mathematics. The method of treatment has been to present a comprehensive treatise on the fundamental principles. With a firm grounding of these fundamental principles, the practitioner is enabled to intelligently design or operate refrigerating machinery. The theoretical and fundamental operating principles are given attention first. This is followed by numerous practical considerations and the application of the fundamental principles to the economic production of ice and refrigeration for various purposes.

The author has drawn extensively on his wide experience as a refrigeration engineer and teacher of refrigeration engineering, for materials for this work.

OVER 1000 PAGES
PROFUSELY ILLUSTRATED
CLOTH BINDING $7.50

Published By
NICKERSON & COLLINS CO.
433 N. WALLER AVE. CHICAGO

A Convenient Binder

for the Educational Material of the Service Engineers' Society

EVERY member of the Society should have one of these binders, as it provides a convenient method of using the educational material sent out by the Society, and also published in THE REFRIGERATION SERVICE ENGINEER.

In this and past issues of THE REFRIGERATION SERVICE ENGINEER are published valuable charts — Complaint Charts and Trouble Chart. Other charts will be published in succeeding issues. Provision is made so that these charts can be cut out of this issue and filed conveniently in the new binder. You should have a binder immediately, so that the charts appearing in this issue will provide a start for your handy reference book. It is attractively stamped on the front cover with the Society's name.

Size 4¼ in. x 7½ in. Holds Standard 3¾ in. x 6¾ in. sheet.

This flexible leather, six-ring binder is designed so that it can be conveniently carried in the pocket and used on the job every day. The educational material sent to each member of the Society will be designed so as to fit this convenient binder, also tables, charts and other valuable data published in THE REFRIGERATION SERVICE ENGINEER. A supply of ruled memorandum paper for making notes and sketches is furnished. The educational material published in THE REFRIGERATION SERVICE ENGINEER and that sent out by the Society will provide a valuable reference book that will be an indispensable help in solving every day servicing problems.

SEND REMITTANCE OF $1.00 TO THE

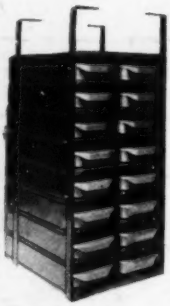
REFRIGERATION SERVICE ENGINEERS' SOCIETY

433 North Waller Avenue CHICAGO, ILL.

Make Sure of Quality

KRAMER

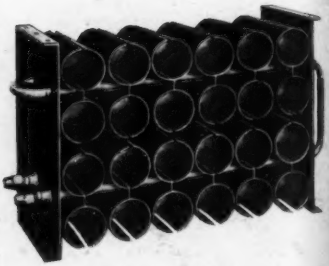
ICE CUBE MAKERS



are of all-copper construction. Tubing is 1/2" O.D. Continuously and metallically processed below each tray sleeve for quick freezing. No soldered connections.

KRAMER

BEER BOTTLE COOLING COILS



cool bottles to any temperature desired. Brass and copper construction. Fit any standard size beer bottle.

Write for Prices and Further Information

[Your Refrigeration Data File is not complete unless it contains literature on Kramer Refrigeration Products.]

TRENTON AUTO RADIATOR WORKS

5145 Liberty Ave.
Pittsburgh, Pa.

TRENTON, NEW JERSEY

241 West 68th St.
N. Y. C.